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METHOD FOR CALIBRATION OF STANDARDIZED BLOCKS FOR VERIFICATION OF KNOOP HARDNESS TESTING MACHINES

UDC 620·115·8 : 620·178·152·346·05

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INDIAN STANDARDS INSTITUTION
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110001

Price Rs [illegible] Gr 2

February 1974

Indian Standard

METHOD FOR CALIBRATION OF STANDARDIZED BLOCKS FOR VERIFICATION OF KNOOP HARDNESS TESTING MACHINES

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Indian Standard

METHOD FOR CALIBRATION OF STANDARDIZED BLOCKS FOR VERIFICATION OF KNOOP HARDNESS TESTING MACHINES

0. FOREWORD

0.1 This Indian Standard was adopted by the Indian Standards Institution on 30 November 1973, after the draft finalized by the Methods of Physical Tests Sectional Committee had been approved by the Structural and Metals Division Council.

0.2 In the preparation of this standard considerable assistance has been derived from ASTM Designation E 384-69 ' Method of test for microhardness of materials ', published by the American Society for Testing and Materials.

0.3 For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test, shall be rounded off in accordance with IS : 2-1960*. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

1. SCOPE

1.1 This standard prescribes the method for calibration of blocks for indirect verification of Knoop hardness testing machines.

1.1.1 This standard does not apply to the calibration of test blocks used in the routine checking of testing machines.

2. MANUFACTURE

2.1 The block shall be specially prepared and the manufacturing process shall be such as to impart necessary homogeneity, stability of structure and uniformity of surface hardness. The fineness and regularity of grains and the uniformity of the metallurgical structure shall be verified by microscopical examination. The block, if made of steel, shall be demagnetized.

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*Rules for rounding off numerical values (*revised*).

2.2 Standardized metal block shall be of a thickness not less than 6 mm.

2.3 The upper and lower surfaces of the block shall be flat within 0·005 mm and the parallelism of the block shall be such that the thickness does not vary by more than 0·010 mm per 50 mm.

2.4 The lower surface of the block shall have a fine ground finish. The test surface (upper surface) shall be highly polished and its roughness shall not exceed 0·001 mm (centre line average). It shall also be free from scratches which interfere with the measurement of the impressions.

2.5 To enable checking that no material is subsequently removed from the block, its thickness at the time of standardization shall be marked on it to an accuracy of 0·01 mm or a suitable identification mark shall be made on the test surface (*see also* **9.1**).

3. PROCEDURE FOR CALIBRATION

3.1 The standardized block shall be calibrated in a standardizing machine using the general procedure as laid down in IS : 6885-1973*. The calibration shall be carried out at a temperature of 20 ± 2°C for temperature climates and 27 ± 2°C for tropical climates.

4. STANDARDIZING MACHINE

4.1 The standardizing machine shall be the one in which the load applied, the form of the indenter and the measuring device may be verified by fundamental measurement. It is recommended that the load should be applied by means of weights giving true values of force.

4.2 Load — The loads shall be correct within ±0·1 percent.

4.3 Form of Indenter

4.3.1 The four faces of the diamond pyramid shall be highly polished and shall be free from flaws.

4.3.2 The indenter shall have an included angle of 172° 30′ ± 5′ on the long axis and 130°0′ ± 5′ on the short axis. The offset at the apex shall not be more than 1 μm.

4.4 Application of Load — The load shall be applied and removed without shock for 10 to 15 seconds.

5. NUMBER OF INDENTATIONS

5.1 On each block at least four groups of indentations consisting of 5 impressions each shall be made.

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*Method for knoop hardness testing of metals.

6. MEASUREMENT OF THE DIMENSIONS OF INDENTATIONS

6.1 The illuminating system of the measuring microscope shall be adjusted to give uniform intensity over the field of view and maximum contrast between the indentation and the undisturbed surface of the block.

6.2 The measuring microscope shall be checked by stage micrometer or by other suitable means to ensure that the difference between readings corresponding to any two graduation lines of the instrument is correct within ± 0·001 mm.

6.3 Each indentation should be measured by at least two observers.

7. REPEATABILITY

7.1 Let d_1, d_2, ………… d_n be the values of the measured diagonals arranged in increasing order of magnitude. The repeatability of the block is defined as $d_n - d_1$ if $n = 10$, that is, if 10 indentations have been made in the block. The repeatability is defined as $1{\cdot}32\ (d_n - d_1)$ if $n = 5$, that is, if 5 indentations have been made in the block.

8. UNIFORMITY OF HARDNESS

8.1 The repeatability of hardness readings as measured by 5 or 10 indentations shall be within the limits given below:

Hardness Range for Standardized Test Blocks, HK	*Repeatability of the Test Block Readings Shall be Less Than*
For loads from 1 to 500 gf:	
100 to 250	5 percent of $\bar{d}$
Over 250 to 650	4 percent of $\bar{d}$
Over 650	3 percent of $\bar{d}$
For loads from 500 to 1 000 gf:	
100 to 250	4 percent of $\bar{d}$
Over 250 to 650	3 percent of $\bar{d}$
Over 650	2 percent of $\bar{d}$

NOTE — $\bar{d}$ is the average of the values of measured diagonals of indentations.

9. MARKING

9.1 Each standardized block shall be marked with the following information:

a) Arithmetic mean of the hardness values found in the standardizing tests,

b) Name or trade-mark of the supplier,

c) Serial number,

d) Thickness of the standardized block, and

e) Test load.

9.2 The standardized face of each block shall bear at least one of the above identification marks. Alternatively, the marking may be made on the side of the block, the marking being upright when the standardized face is the upper face.

9.3 Each standardized block may also be marked with the ISI Certification Mark.

NOTE — The use of the ISI Certification Mark is governed by the provisions of the Indian Standards Institution (Certification Marks) Act and the Rules and Regulations made thereunder. The ISI Mark on products covered by an Indian Standard conveys the assurance that they have been produced to comply with the requirements of that standard under a well-defined system of inspection, testing and quality control which is devised and supervised by ISI and operated by the producer. ISI marked products are also continuously checked by ISI for conformity to that standard as a further safeguard. Details of conditions under which a licence for the use of the ISI Certification Mark may be granted to manufacturers or processors, may be obtained from the Indian Standards Institution.

INDIAN STANDARDS

ON

HARDNESS TESTS

IS:	
1500-1968	Method for Brinell hardness test for steel (*first revision*)
1501-1968	Method for Vickers hardness test for steel (*first revision*)
1586-1968	Method for Rockwell hardness test (B and C scales) for steel (*first revision*)
1754-1968	Method for verification of vickers hardness testing machine (*first revision*)
1789-1961	Method for Brinell hardness test for grey cast iron
1790-1961	Method for Brinell hardness test for light metal and their alloys
1810-1961	Method for Vickers hardness test for light metal and their alloys
2281-1968	Method for verification of Brinell hardness testing machines (*first revision*)
2866-1965	Method for Vickers hardness test for copper and copper alloys
3054-1965	Method for Brinell hardness test for copper and copper alloys
3754-1967	Method for Calibration of standardized blocks to be used for Rockwell B and C scale hardness testing machines
3804-1966	Method for calibration of Rockwell B and C scales hardness testing machines
4132-1967	Method for calibration of standardized blocks to be used for Brinell hardness testing machines
4133-1967	Method for calibration of standardized blocks to be used for Vickers hardness testing machines
4258-1967	Hardness conversion tables for metals
5072-1969	Method for Rockwell superficial hardness test (N and T scales) for steel
5073-1969	Method for verification of Rockwell superficial (N and T scales) hardness testing machines
5076-1969	Method for calibration of standardized blocks to be used for Rockwell superficial N and T scale hardness testing machines
6885-1973	Method for knoop hardness testing of metals

INDIAN STANDARDS INSTITUTION
Manak Bhavan, 9 Bahadur Shah Zafar Marg, NEW DELHI 110001
Telephone : 27 01 31 (20 (lines) **Telegrams : Manaksanstha**

Branch Offices:	Telephone
' Sadhna ', Nurmohamed Shaihh Marg, Khanpur, AHMEDABAD 380001	2 03 91
F Block, Unity Bldg, Narasimharaja Square, BANGALORE 560002	2 76 49
534 Sardar Vallabhbhai Patel Road, BOMBAY 400007	35 69 44
5 Chowringhee Approach, CALCUTTA 700013	23-08 02
Flat No. 1030-31 (First Floor), Sector 22B, CHANDIGARH 160022	2 83 20
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117/418 B Sarvodaya Nagar, KANPUR 208005	82 72
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B. C. I. Bldg (Third Floor), Gandhi Maidan East, Patna 800004	2 56 55

Printed at Neelkamal Printers, Delhi, India